Date of Issue:
23 June 2014

SAFETY DATA SHEET

1. Substance and Source Identification

Product Identifier

SRM Number: 3177
SRM Name: Mercuric Chloride ($HgCl_2$) Standard Solution
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of mercury when the chemical form of mercury is high-purity mercuric chloride (mercury (II) chloride). A unit of SRM 3177 consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically from high-purity mercury (II) chloride to contain a known mass fraction of mercury. The solution contains nitric acid at a volume fraction of approximately 3 % and hydrochloric acid at a volume fraction of approximately 4 %.

Company Information

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2. Hazards Identification

Classification

Physical Hazard:	Not classified.	
Health Hazard:	Acute Toxicity, Oral	Category 4
	Skin Corrosion/Irritation	Category 1B
	Serious Eye Damage/Eye Irritation	Category 1

Label Elements

Symbol

Signal Word

DANGER

Hazard Statement(s)

H302	Harmful if swallowed.
H314	Causes severe skin burns and eye damage.

Precautionary Statement(s)

P260	Do not breathe fumes, mists, vapors, or spray.
P264	Wash hands thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	Wear protective gloves, protective clothing, and eye protection.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Remove immediately all contaminated clothing. Rinse skin with water.
P304+P340	If inhaled: Remove person to fresh air and keep comfortable for breathing.

P305+P351+P338	If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a doctor.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents and container according to local regulations.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Nitric Acid/Hydrochloric Acid/Mercury (II) Chloride Solution

Other Designations:

Nitric Acid (aqua fortis; hydrogen nitrate; azotic acid; engraver's acid)
Hydrochloric Acid (hydrogen chloride acid)
Mercury (II) Chloride [mercury (II) dichloride; mercury (II) (2+) salt (2:1); mercuric chloride, mercury chloromercurate (II); corrosive sublimate; bichloride of mercury; corrosive mercury chloride]

NOTE: Mercury (II) chloride in hydrochloric acid and nitric acid forms a solvated mercury (II) chloride salt. The health and physical hazard information provided in this MSDS are for hydrochloric acid, nitric acid, and mercury (II) chloride.

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Nitric acid	7697-37-2	231-714-2	3
Hydrochloric acid	7647-01-0	231-595-7	1.7
Mercuric (II) chloride	7487-94-7	231-299-8	0.1
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	>95

4. FIRST AID MEASURES

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. Seek immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Seek immediate medical attention. Destroy contaminated shoes.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

Ingestion: Contact a poison control center immediately for instructions. Give water to rinse out mouth. Never give liquids to a person with reduced awareness or becoming unconscious. If vomiting occurs, keep head lower than hips to prevent aspiration. If not breathing, give artificial respiration by qualified personnel. Seek immediate medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Acid burns to skin, eyes, and lungs. Mercuric chloride is highly toxic (concentration in this SRM is 0.1 %).

Indication of any immediate medical attention and special treatment needed, if necessary: If any of the above symptoms are present, seek immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:

Suitable: Use extinguishing media appropriate to the surrounding fire.
Unsuitable: None listed.

Specific Hazards Arising from the Chemical: Thermal decomposition products: hydrogen chloride, acid halides.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

NFPA Ratings (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 3 Fire = 0 Reactivity = 0

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Do not touch spilled material. Notify safety personnel of spills. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Isolate hazard area and deny entry.

7. HANDLING AND STORAGE

Safe Handling Precautions: Handle glass ampoules with care. See Section 8, "Exposure Controls and Personal Protection".

Storage: Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (see Section 10, "Stability and Reactivity").

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits			
Components	**OSHA (PEL)**	**ACGIH (TLV)**	**NIOSH (REL)**
Nitric acid	TWA: 5 mg/m^3 (2 ppm)	TWA: 5 mg/m^3 (2 ppm) STEL: 10 mg/m^3 (4 ppm)	TWA: 5 mg/m^3 (2 ppm) STEL: 10 mg/m^3 (4 ppm) IDLH: 65 mg/m^3 (25 ppm)
Hydrochloric Acid	Ceiling: 7 mg/m^3 (5 ppm)	Ceiling: 3 mg/m^3 (2 ppm)	Ceiling: 7 mg/m^3 (5 ppm) IDLH: 50 ppm
Mercury (II) Chloride (as total Hg)	TWA: 0.1 mg/m^3	TWA: 0.025 mg/m^3 (related to Mercury inorganic compounds) Skin - potential significant contribution to overall exposure by the cutaneous route (related to Mercury inorganic forms)	TWA: 0.05 mg/m^3 (vapor), 0.1 mg/m^3 ceiling, IDLH: 10 mg/m^3, except organo (alkyl) compounds as Hg, related to mercury compounds Potential for dermal absorption (related to Mercury compounds)

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eyewash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

NOTE: The physical and chemical data provided are for the pure hazardous components. No physical or chemical data are available for this solution of mercuric (II) chloride, nitric acid and hydrochloric acid.

	Nitric acid (3 %)	**Hydrochloric acid (1.7 %)**	**Mercuric (II) chloride (0.1 %)**
Descriptive Properties			
Appearance (physical state, color, etc.):	colorless to yellow liquid	colorless to yellow liquid	colorless or white crystalline powder
Molecular Formula	HNO_3	HCl	$HgCl_2$
Molar Mass (g/mol)	63.01	36.46	271.50
Odor	irritating odor	not available	odorless
Odor threshold	not available	not available	not available
pH	1 (1 M)	<2	3.2 (0.2 M)
Evaporation rate (ether = 1)	not available	>1	not available
Melting point/freezing point	–42 ºC (–43 ºF)	not available	not available
Sublimation Point	not applicable	not applicable	275 ºC to 287 ºC (527 ºF to 548 ºF)
Relative Density as specific gravity (water = 1)	1.0527	1.0 to 1.2	5.44
Vapor Pressure	47.9 mmHg at 20 ºC	14 mmHg at 20 ºC	1.3 mmHg at 236 ºC
Vapor Density (air = 1)	3.2	not available	8.7
Viscosity (cP)	not available	not available	not available
Solubility(ies)	miscible with water and ether	miscible with water	not available
Partition coefficient (n-octanol/water)	not available	not available	not available
Thermal Stability Properties:			
Autoignition Temperature	not applicable	not applicable	not available
Thermal Decomposition	not applicable	not applicable	not available
Initial boiling point and boiling range:	83 ºC (181 ºF)	not available	301 ºC to 304 ºC (574 ºF to 579 ºF)
Explosive Limits, LEL (Volume %)	not applicable	not applicable	not available
Explosive Limits, UEL (Volume %)	not applicable	not applicable	not available
Flash Point	not applicable	not applicable	not available
Flammability (solid, gas)	not applicable	not applicable	not applicable

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: X Stable _____ Unstable

Possible Hazardous Reactions: May react with evolution of heat; release toxic, corrosive, flammable or explosive gases on contact with water.

Conditions to Avoid: Heat, flames, sparks and other sources of ignition. May ignite or explode on contact with combustible materials.

Incompatible Materials: Cyanides, metals, amines, bases, metal carbide, oxidizing materials, acids, halo carbons, combustible materials, halogens, metal salts.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Thermal decomposition will produce hydrogen chloride gas, chlorine.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: X Inhalation X Skin _____ Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Burning pain, severe skin corrosion, and eye damage. Mercury (II) chloride can cause potentially fatal on contact with the skin or swallowed.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: Hydrochloric acid and nitric acid can damage the mucous membranes and upper respiratory tract. Short term exposure may cause irritation and inflammation of the upper respiratory tract, coughing, choking, sore throat, shortness of breath, headache, dizziness, and nausea. Long term exposure to acid fumes may cause damage to teeth, bronchial irritation, chronic cough, bronchial pneumonia, and gastrointestinal disturbances. Mercury (II) Chloride: Short-term exposure may cause irritation (possibly severe), allergic reactions, metallic taste, nausea, vomiting, diarrhea, chest pain, difficulty breathing, headache, lung damage, and kidney damage. Long-term exposure may cause blue lines on gums, loosening of teeth, nerve damage, and reproductive effects.

Skin Contact: Hydrochloric acid and nitric acid can cause severe skin burns. Severity of the damage depends on the concentration and duration of exposure. Effects of acid burns may be delayed. Mercury (II) Chloride: Short-term and long-term exposure may cause irritation (possibly severe), allergic reactions, and death.

Eye Contact: Hydrochloric acid and nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Severity of the damage depends on the concentration and duration of exposure. Mercury (II) chloride: Short-term and long-term exposure may cause irritation (possibly severe).

Ingestion: If ingested, concentrated hydrochloric acid can cause burns to the gastrointestinal tract. Mercury (II) chloride: Short-term and long-term effects same as inhalation, including nerve damage, tumors.

Numerical Measures of Toxicity:

Acute Toxicity: Category 4, Oral
Nitric acid, Rat, Inhalation LC50: 130 mg/m^3 (4 h)
Hydrochloric acid: Rat, Inhalation LC50: 3124 ppm (1 h); 1562 ppm (4 h)
Hydrochloric acid: Rat, Oral LD50: 700 mg/kg
Mercuric (II) chloride: Rat, Oral LD50: 1 mg/kg
Mercuric (II) chloride: Rat, Dermal LD50: 41 mg/kg

Skin Corrosion/Irritation: Category 1B
This SRM contains >1 % hydrochloric acid and nitric acid and it is classified as Category 1B.

Serious Eye damage/Eye irritation: Category 1
This SRM contains >1 % hydrochloric acid and nitric acid and it is classified as Category 1.

Respiratory Sensitization: No data available.

Skin Sensitization: No data available.

Germ Cell Mutagenicity: No data available.

Carcinogenicity: Not classified.
Listed as a Carcinogen/Potential Carcinogen _____ Yes X No
Nitric acid is not listed by NTP, IARC or OSHA as a carcinogen or a potential carcinogen.
Hydrochloric acid and Mercuric (II) chloride are listed by IARC as group 3, *not classifiable* and not listed by NTP or OSHA as a carcinogen/potential carcinogen.
Mercuric (II) chloride: Mutagenic – *Baccillus subtilis*: 50 mmol/L
Mercuric (II) chloride: Tumorigenic – Mouse, Oral (TDLo): 5150 mg/kg (103 wk)

Reproductive Toxicity: Not classified.
Hydrochloric acid: Rat, Oral TCLo: 450 mg/kg (1 h, prior to copulation 1 d)
Nitric acid, Rat, Oral TDLo: 21 150 mg/kg (pregnant 1 d to 21 d)
Nitric acid, Rat, Oral TDLo: 2345 mg/kg (pregnant 18 d)
Mercuric (II) chloride: Mouse, Inhalation TCLo: 230 µg/m^3 (4 h, pregnant 9 d–12 d)

Specific Target Organ Toxicity, Single Exposure: Not classified.

Specific Target Organ Toxicity, Repeated Exposure: Not classified.

Aspiration Hazard: No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data

Nitric acid

Starfish (*Asterias rubens*) LC50 [renewal/aerated water]: 100 mg/L to 300 mg/L (48 h)

Hydrochloric acid

Fish Toxicity: Mosquitofish (*Gambusia affinis*) LC50 (static): 282 mg/L (96 h)

Invertebrate: Shore crab (*Carcinus maenas*) LC50 (mortality): 240 mg/L (48 h)

Mercury (II) chloride

Fish Toxicity: Rainbow trout (*Oncorhynchus mykiss*) LC50 (static): 0.13 mg/L – 0.19 mg/L (96 h)

Persistence and Degradability: No data available.

Bioaccumulative Potential: No data available.

Mobility in Soil: Hydrogen chloride will evaporate from dry soil surfaces and dissociate into chloride and hydronium ions in moist soil.

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of waste in accordance with all applicable federal, state, and local regulations. Hydrochloric acid subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Number: D002.

Dispose in accordance with all applicable federal, state, and local regulations. Mercury Hazardous Waste Number D009. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level (0.2 mg/L).

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: UN1760, Corrosive liquid n.o.s. (contains nitric acid and hydrochloric acid), Hazard Class 8, Packing Group II.

15. REGULATORY INFORMATION

U.S. Regulations

CERCLA Sections 102a/103 (40 CFR 302.4): Nitric Acid, 1000 lbs (454 kg) final RQ.
Hydrochloric Acid, 5000 lb (2270 kg) final RQ.

SARA Title III Sections 302 (40 CFR 355.30): Nitric Acid, 1000 lbs TPQ.
Hydrochloric Acid, 500 lb TPQ (gas only).
Mercury (II) Chloride, 500 lbs lower TPQ and 10 000 lbs upper TPQ.

SARA Title III Sections 304 (40 CFR 355.40): Nitric Acid, 1000 lbs EPCRA RQ.
Hydrochloric Acid, 5000 lb RQ (gas only).
Mercury (II) Chloride, 500 lbs EPCRA RQ.

SARA Title III Sections 313 (40 CFR 372.65): Nitric Acid, 1.0 % de minimis concentrations.
Hydrochloric Acid, 1.0 % de minimis concentrations; (acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size).
Mercury (II) Chloride, 1.0 % de minimis concentrations, supplier notification limit (Chemcial category N458, related to Mercury compounds).

OSHA Process Safety (29 CFR 1910.119): Nitric Acid at higher concentrations ($\geq$94.5 %) is regulated.
Hydrochloric Acid: 5000 lbs (2270 kg) TQ (anhydrous) is regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH:	Yes
CHRONIC HEALTH:	Yes
FIRE:	No
REACTIVE:	No
PRESSURE:	No

State Regulations

California Proposition 65: WARNING! This product contains a chemical (mercury) known to the state of California to cause reproductive/developmental effects.

U.S. TSCA Inventory: Hydrochloric acid, nitric acid, and mercury (II) chloride are listed.

TSCA 12(b), Export Notification: Not listed.

Canadian Regulations: WHMIS Information is not provided for this material.

16. OTHER INFORMATION

Issue Date: 23 June 2014

Sources: ChemAdvisor, Inc., MSDS *Hydrochloric Acid*, 21 March 2014.

ChemAdvisor, Inc., MSDS *Mercuric Chloride*, 21 March 2014.

ChemAdvisor, Inc., MSDS *Nitric Acid*, 21 March 2014.

Hazardous Substances Data Bank, National Library of Medicine, *Hydrochloric Acid CAS 7647-01-0*, Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (accessed Jun 2014).

NIOSH Pocket Guide to Chemical Hazards, *Hydrochloric Acid CAS No. 7647-01-0*, available at http://www.cdc.gov/niosh/npg/npgd0332.html (accessed Jun 2014).

Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, *Nitric Acid CAS No. 7697-37-2*; available at http://toxnet.nlm.nih.gov (accessed Jun 2014).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NRC	Nuclear Regulatory Commission
ALI	Annual Limit on Intake	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transportation Agency	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration, 50 %	STEL	Short Term Exposure Limit
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NFPA	National Fire Protection Association	TWA	Time Weighted Average
NIOSH	National Institute for Occupational Safety and Health	UEL	Upper Explosive Limit
NIST	National Institute of Standards and Technology	WHMIS	Workplace Hazardous Materials Information System
n.o.s.	Not Otherwise Specified		

Disclaimer: Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate of Analysis.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srmmsds@nist.gov; or via the Internet at http://www.nist.gov/srm.